Mark schemes

1

(a) electric current
(rate of) flow of (electric) charge / electrons

accept $I = \frac{Q}{t}$

with Q and t correctly named

1

potential difference
work done / energy transferred per coulomb of charge
(that passes between two points in a circuit)

accept $V = \frac{W}{Q}$

with W and Q correctly named

1

(b) metals contain free electrons (and ions)

accept mobile for free

1

as temperature of filament increases ions vibrate faster /
with a bigger amplitude

accept atoms for ions

accept ions/atoms gain energy

accept vibrate more for vibrate faster

do not accept start to vibrate

1

electrons collide more (frequently) with the ions
or
(drift) velocity of electrons decreases

do not accept start to collide

*accept increasing the p.d. increases the temperature (**1** mark)*

and

*(and) resistance increases with temperature (**1** mark) if no other marks scored*

1

(c) 7.8

*allow **1** mark for obtaining value 1.3 from graph*

***or** allow **1** mark for a correct calculation using an incorrect current in the range 1.2-1.6 inclusive*

2

[7]

2 (a) (i) 50 000

*allow **1** mark for correct substitution, ie*

6 = 0.00012 × R

***or** 6 = 0.12 × R*

***or** answers of 25 000 or 50 gain **1** mark*

***or** allow 1 mark for an incorrect answer caused by one error only ie using 3V or an incorrect conversion of current*

2

ohm / Ω

*an answer 50kΩ gains **3** marks*

1

(ii) (body) resistance changes

or

body fat/resistance affected by (many) factors

accept named factor, eg age, gender, height, fitness, bone structure, muscle, drinking water related to body fat / resistance

1

(iii) gives misleading / wrong/inaccurate value

do not credit if specifically linked to a change in mass / weight

1

(because) high water content changes body resistance

accept a specific change to resistance

water changes body mass is insufficient

1

(b) (i) RCCB – detects difference between current in live and neutral (wires)

accept RCCB can be reset

1

fuse – (overheats and) melts

accept blows for melts

1

(ii) switches the circuit / hedge trimmers off within 60 milliseconds

*allow for **1** mark the RCCB / it is (very) fast.*

do not accept the bigger the current the faster the RCCB switches off

2

[10]

3 Fan C

1

Kettle B

1

Lamp D

1

Radio E

1

[4]

4 (a) (i) 0.6
or
60%

*allow **1** mark for correct substitution ie* $\frac{720}{1200}$ *provided no subsequent step shown*

*an answer of 0.6 / 60 with a unit gains **1** mark only*
*an answer of 60 gains **1** mark only*

2

(ii) heat

allow thermal

1

(b) 12 000 p
or
£120

to score both marks the unit must be consistent with the numerical answer
*answers 12 000 and 120 gain **1** mark only*
*allow **1** mark for correct substitution ie 800 × 15 **or** 800 × 0.15*
provided no subsequent step shown

2

[5]

5 (a) (i) 7.6

*allow **1** mark for correct substitution and / or transformation*

ie $0.95 = \frac{x}{8}$

95 × 8.0

2

(ii) 25 (hours)

*allow **1** mark for obtaining number of kWh = 200*

an answer of 26(.3) gains both marks

2

(b) any **two** from

- transferred to the surroundings / air / atmosphere
- becomes spread out
- shared between (many) molecules
- (wasted as) heat / sound

2

[6]

6

(a) (i) 6

1

(ii) variable resistor

1

(iii) voltmeter

1

(b) (i) point at 3 V ringed

1

(ii) The student misread the ammeter.

1

(iii) 1 (volt)

accept every volt

1

(c) as one increases so does the other
or
directly proportional
or
positive correlation

accept a numerical description, eg when one doubles the other also doubles

1

[7]

7 (a) (i) 720

*allow **1** mark for correct substitution,*

ie 72 × 10 provided no subsequent step shown

2

(ii) 720

or

their (a)(i)

1

(b) (i) gravitational potential

allow gravitational

allow potential

1

(ii) 432

*allow **1** mark for correct substitution, ie* $\frac{21600}{50}$ *provided no subsequent step shown*

2

watt / W

1

[7]

8 (a) (i) circuit not complete

accept circuit is broken

accept switch / s are open / off

1

(ii) 9

*allow **1** mark for correct substitution, ie 0.5 × 18 provided no subsequent step shown*

2

(iii) 36

1

(b) can be switched on / off from top or bottom of stairs

1

(c) (i) (electric) shock

accept fitting becomes live

accept answers giving a possible consequence of electric shock, eg death

1

(ii) connect the earth wire

1

[7]

9 (a) electrons transfer / removed

*do **not** accept negatively charged atoms for electrons*

this only scores if first mark given

1

to the rod / from the cloth

this does not score if there is reference to any original charge on cloth or rod

'it' refers to the rod

*accept negative charge transfer to rod / removed from cloth for **1** mark*

transfer of positive charge / positive electrons scores zero

1

(b) (i) rods / charges repel

1

creating downward / extra force (on the balance)

accept pushing (bottom) rod downwards

do not accept increasing the weight / mass

charges attracting scores zero

1

(ii) the (repulsion) force increases as the distance between the charges decreases

accept there is a negative correlation between (repulsion) force and distance between charges

or

(repulsion) force and distance between charges are inversely proportional

for both marks

*examples of **1** mark answers*

force increases as distance decreases

force and distance are inversely proportional

negative correlation between force and distance

repels more as distance decreases

if given in terms of attracting or attraction force this mark does not score

2

[6]

10 (a) (i) also double

increases is insufficient

1

(ii) variable resistor

accept rheostat / potentiometer

1

(b) (i) the data / results / variables are continuous

accept data / results / variables are not categoric / discrete

1

(ii) misreading the ammeter

*do **not** accept misreading the meter / results*

*do **not** accept misreading the ammeter and / or voltmeter*

reading / human error is insufficient

1

(iii) straight line from the origin drawn passing close / through points at 1 V, 5 V, 6 V and ignoring anomalous point

*do **not** accept line drawn 'dot-to-dot'*

1

(iv) yes

mark is for the reason

supports prediction
or
(straight) line passes through the origin

accept a mathematical argument, eg when p.d. went from 2 to 4 the current went from 0.3 to 0.6

it's directly proportional is insufficient

1

[6]

11 (a) (i) (connect) 30 (cells)

1

in series

1

(ii) current always flows in the same direction
or
current only flows one way

1

(iii) 36 000

*allow **1** mark for correctly converting 2 hours to 7200 seconds*

*answers 10 or 600 score **1** mark*

2

coulombs / C

*do **not** accept c*

1

(b) (i) 2160

*allow **1** mark for correct substitution, ie ½ × 120 × 6^2*

*answers of 1620 or 540 score **1** mark*

2

(ii) reduce it

1

any **one** from:

- draws a larger current (from battery)
- motor draws greater power (from battery)

  accept energy per second for power

  accept more energy needed to move the bicycle
- greater resistance force (to motion) / air resistance / drag / friction

  accept less streamlined

  more mass to carry is insufficient

1

[10]

12 (a) (i) 4.5

1

(ii) 2.25 or their (a)(i) ÷ 2 correctly calculated

1

(iii) V_2

1

(b) (i) 30

1

(ii) 8

*allow **1** mark for correct substitution*

ie 0.4 × 20

*allow **1** mark for answers of 4 or 12*

2

(iii) **Y**

1

[7]

13 (a) (i) **D**

1

(ii) plastic or rubber

accept a specific type of plastic

accept electrical insulator

1

(b) 460

*allow **1** mark for correct substitution ie 2 × 230*

2

(c) any **two** from:

- not all appliances need a 13 A fuse

  idea that 13 A is (much) bigger than required by many appliances

  *do **not** accept some appliances require more than 13 A*

  *do **not** accept 13 A fuse will blow*

- can choose the most suitable fuse (for the appliance)

  accept install correct fuse for the appliance

- (in the event of a fault) 13 A fuse may allow too much current to flow through an appliance
  or
  fuse may not melt (before appliance is damaged)

- may already have the fuse

  idea of reusing a fuse

  *do **not** accept cheaper unless explained correctly*

2

[6]

14 (a) 3rd box

The negative charge in the water is repelled by the rod and the positive charge is attracted.

1

(b) (i) friction between bottles and conveyor belt / (plastic) guides

accept bottles rub against conveyor belt / (plastic) guides

1

charge transfers between bottles and conveyor belt / (plastic) guides

accept specific reference

eg electrons move onto / off the bottles

reference to positive electrons / protons negates this mark

1

(ii) an atom that has lost / gained electron(s)

*do **not** accept a charged particle*

1

(iii) charge will not (easily) flow off the conveyor belt

accept the conveyor belt / bottle is an insulator / not a conductor

accept conveyor belt is rubber

1

[5]

15 (a) diode

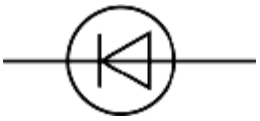
accept LED

1

(b) all symbols correct

must include at least voltmeter and diode

1



diode

allow ecf from part (a) if the component is not identified as a diode

allow symbol without the line through triangle

ignore polarity of diode

voltmeter in parallel with component added in series

*any additional components must not affect the ability to measure **V** and **I** for the diode / their (a)*

1

(c) (i) 0.05

accept 50 mA

accept between 0.048 and 0.050 inclusive

1

(ii) 16

$\frac{0.8}{}$

their (c)(i) correctly calculated gains both marks

*allow **1** mark for correct transformation and substitution*

$\frac{0.8}{0.05}$ or $\frac{0.8}{\text{their (c)(i)}}$

allow 17 if using 0.048

2

[6]

16 (a) (i) 0.25 (A)

1

(ii) 75

*allow **1** mark for converting 5 minutes to 300 seconds*
***or** allow **1** mark for correct substitution*
ie 0.25 × 300
*allow **1** mark for an answer 1.25*
*allow **1** mark only for their (a)(i) × 300 correctly calculated*

2

coulombs or C

*do **not** accept c*

1

(b) any **two** from:

- fault not repaired
  accept if a fault was to occur
- larger current will (still) flow
- aluminium foil will not melt (if a fault)
  accept aluminium foil needs a higher current / charge to melt
- wiring will overheat / (may) cause a fire
  accept idea of fire hazard
  *do **not** accept explode etc*

2

[6]

17 (a) radio

radio must be chosen for reason to score

1

gives out sound

inclusion of other forms of energy negates mark

or

others give out heat / thermal energy

1

(b) Kettle

accept 2.5 (kW)

1

(c) 60 (p)

accept £0.6(0)
*allow **1** mark for correct substitution ie 4 × 15*
substitution only scores if no subsequent step shown
*£60 scores **1** mark*

2

(d) (bigger volume) takes more time (to boil)

accept explanation using data from graph

1

(so) more energy transferred

*do **not** accept electricity for energy*

1

(and) this costs more money

ignore references to cost of water

1

[8]

18 (a) fleece rubs against shirt

it refers to the fleece

1

or
friction (between fleece and shirt)

(causing) <u>electrons</u> to transfer from one to the other

accept a specific direction of transfer
*do **not** accept charge for electrons*
positive electrons negates this mark
movement of protons negates this mark

1

(b) Electrical charges move easily through metals.

1

An electric current is a flow of electrical charge.

1

(c) (i) copper

reason only scores if copper chosen

1

(good electrical) conductor

accept it is a metal
any mention of heat conduction negates this mark

1

(ii) lower than

1

(iii) accept any sensible suggestion,eg:

- too many variables (to control)
- lightning strikes / storms are random / unpredictable
- do not know which building will be struck
- do not know when a building will be struck
- do not know when lightning will happen
- (very) difficult to create same conditions in a laboratory
- lightning storms are not the same

it is not safe is insufficient

*do **not** accept lightning does not strike the same place twice*

1

[8]

19 (a) brown

1

(b) outside / case is plastic / an insulator

accept is double insulated

accept non-conductor for plastic

*do **not** accept it / hairdryer is plastic*

1

(c) (i) (1) S_1

and no other

1

(2) S_1 and S_3

both required, either order

1

(ii) S_1 must be ON (for either heater to work)

*do **not** accept reference to 'fan' switch*

1

S_1 switches the fan on

1

(d) 1495

*allow **1** mark for correct substitution*

ie, 6.5 × 230

2

watt(s) or W

*an answer of 1.495 kW gains **3** marks*

although the unit is an independent mark for full credit

the unit and numerical value must be consistent

accept joules per second or J/s

1

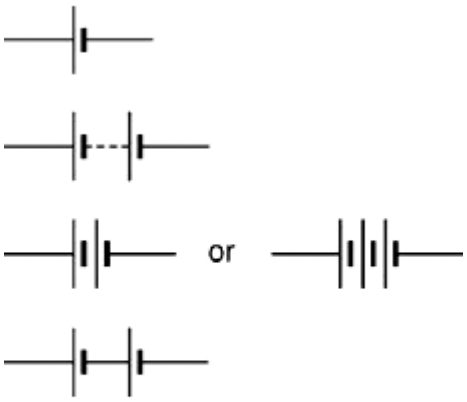
[9]

20 (a) (i) ammeter and battery **in series** with the **gauge**

symbols must be correct

ignore a voltmeter drawn in series

accept



not

or cells reversed to cancel out

1

voltmeter in parallel with the gauge

symbol must be correct

accept a freestanding circuit

diagram provided strain gauge is labelled or a resistor symbol used for the strain gauge

1

(ii) d.c. flows only in one direction

a.c. changes direction is insufficient

1

(b) (i) 75

this answer only

*allow **1** mark for correct substitution **and** transformation,*

ie resistance = $\frac{3.0}{0.040}$

2

(ii) increases

1

(iii) elastic / strain potential

*do **not** accept potential*

1

[7]

21 (a) transferred to surroundings / surrounding molecules / atmosphere

'it escapes' is insufficient

or

becomes dissipated / spread out

accept warms the surroundings

accept degraded / diluted

accept a correct description for

surroundings eg to the washing machine

*do **not** accept transformed into heat on its own*

1

(b) a smaller proportion / percentage of the energy supplied is wasted

owtte

*accept a statement such as 'less energy is wasted' for **1** mark*

*do **not** accept costs less to run*

ignore references to uses less energy

2

(c) (i) 2.4 (p)

accept 2 p if it is clear from the working out this is rounded from 2.4 p

*allow **1** mark for correct substitution of correct values*

ie 0.2 × 12

*allow **1** mark for calculating cost at 40 °C (13.2 p)*

or

cost at 30 °C (10.8 p)

2

(ii) any **one** from:

- less electricity needed

  ignore answers in terms of the washing machine releasing less energy

  an answer in terms of the washing machine releasing CO_2 negates the mark

  *do **not** accept less energy is produced*

- fewer power stations needed

- less fuel is burned

  accept a correctly named fuel

  *do **not** accept less fuel is needed*

1

[6]

22 (a) switch

allow answer circled in box

1

(b) 24

1

(c) equal to 0.25 A

1

(d) 4

1

[4]

23 (a) repel

1

opposite

1

attract

1

correct order only

(b) refuelling an aircraft

reason cannot score if refuelling aircraft is not chosen

1

a spark may cause an explosion / fire / ignite the fuel

accept the static for a spark

accept named fuel

there must be a consequence of having a spark

*do **not** accept answers in terms of people getting a shock or electrocuted*

1

[5]

24 (a) a light-dependent resistor

1

(b) any **three** from:

- resistance starts at 500 (kilohms)
- (resistance) falls rapidly as intensity increases from 0

  accept resistance falls

  accept brightness for intensity
- (resistance) halves between 10 and 20 lux
- (resistance) falls slightly between 20 and 50 lux

  or
- (resistance) almost constant / levels out between 20 and 50 lux
- at 50 lux, resistance = 10 (kilohms)

  for full credit the word resistance must be used correctly at least once

  *an answer resistance falls as intensity increases gains **2** marks - this may be combined with one of the bullet point marks for full credit*

3

(c) (i) decrease

1

(ii) resistance increases

this can score without (c)(i)

1

(d) A circuit to switch on security lighting when it gets dark.

1

[7]

25 (a) (i) light dependent resistor / LDR

accept ldr

1

(ii) 25 (kilohms)

accept 24 - 26 inclusive

accept 25 000 Ω

1

(iii) 5 (V) or their (a)(ii) correctly converted to ohms × 0.0002 correctly calculated

*allow **1** mark for converting 25 kΩ /*

their (a)(ii) to ohms

or

*allow **1** mark for correct substitution*

ie 0.0002 × 25(000)

***or** 0.0002 × their (a)(ii)*

allow an incorrect conversion from kilohms providing this is clearly shown

2

(b) (i) linear scale

using all of the available axis

must cover the range 4 - 6 v

***or** their (a)(iii) - 6 v and lie within the range 0 - 15 inc.*

1

(ii) negative gradient line

*do **not** allow lines with both positive and negative gradients*

1

passing through 20 lux and their (a)(iii)

only scores if the first mark is awarded

only scores if line does not go above 6 volts

1

(c) (i) 37.5 (kΩ) or their (a)(ii) + 50 % (a)(ii) correctly calculated

1

(ii) light intensity value would be unreliable / not accurate

1

due to variation in <u>resistance</u> value

accept because resistance varies by ± 50 %

accept tolerance of resistor is too great

*do **not** accept results are not accurate*

1

[10]

26 (a) each hair gains the same (type of) charge

or

(each) hair is negatively charged

*do **not** accept hair becomes positively charged*

or

(each) hair gains electrons

1

similar charges repel

accept positive charges repel

providing first marking point is in terms of positive charge

or

negative charges repel

or

electrons repel

1

(b) 0.000002

*accept correct substitution and transformation for **1** mark*

or

2×10^{-6}

ie 30 / 15 or .03 / 15000 or 30 / 15000 or .03 / 15

or

2 μ C

*answers 2 and 0.002 gain **1** mark*

2

(c) current

*do **not** accept amp / amperes*

1

[5]

27 (a) (i) 2(.0)

accept 2000 W or 2000 watt(s)

accept answer given in table

*do **not** accept 2000*

1

(ii) 4.5

*allow **1** mark for correct substitution*

ie 1.5 × 3

*allow **1** mark for the answers 1.5 or 6(.0)*

2

(iii) 54

or

their (a)(ii) × 12 correctly calculated

*allow **1** mark for correct substitution*

ie 4.5 × 12

or

their (a)(ii) × 12

*allow **1** mark if correct answer is given in pounds eg £54*

2

(b) (i) 6 pm

1

temperature starts to rise faster

only scores if 6 pm given

or

graph (line) is steeper / steepest

it refers to graph gradient or temperature

accept answers in terms of relative temperature rise

eg 5 to 6 pm 2 °C rise, 6 to 7 pm 6 °C rise

accept temperature rises sharply / rapidly / quickly

*do **not** accept temperature starts to rise*

1

(ii) middle box ticked

1

[8]

28 (a)

accept 'the humpback bridge' symbol

accept circle with cross but no lines

if more than one symbol drawn, no mark unless lamp is labelled

1

(b) (i) 24

*allow **1** mark for correct substitution ie* $\frac{2800}{120}$

*allow **1** mark for an answer 1440*

ignore any unit

2

(ii) watt

1

(c) larger than

accept correct indication inside the box

accept an answer meaning larger than ie greater than

1

[5]

29 **L**

N

M

K

all four in the correct order

***2** marks for 2 correct*

***1** mark for 1 correct*

[3]

30 (a) (i) connect the earth wire (to pin)

answers must be in terms of correcting the faults

1

screw cable grip (across cable)

accept tighten the cable grip

1

(ii) earth (wire)

accept the green and yellow (wire)

1

(iii) any **two** from:

- fuse gets (very) hot
- fuse melts

  accept blows for melts

  *do **not** accept break / snap fuse / blow up*
- circuit breaks/ switches off

  accept stops current flowing

2

(b) any **two** from:

it refers to hairdryer

- hairdryer is plugged into mains (electricity socket)

  hairdryer works from the mains

  or

  hairdryer is using 230 V

  accept 240 for 230

- water conducts electricity

  *do **not** accept water and electricity don't mix*

- radio is low power / current / pd / voltage

  accept radio not connected to the mains

  *do **not** accept radio is waterproof*

- (the current in / p.d.across) hairdryer more likely to give a (fatal) electric shock

  accept the idea of electrocution if hairdryer is wet

  accept the idea of radio not causing electrocution if wet

2

[7]

31 (a) 125

*allow **1** mark for obtaining time period = 0.008 (s)*

or

frequency = 1 / time period (or their calculated time period)

2

hertz

or

Hz

*do **not** accept hz*

1

(b) 50 (hertz)

1

[4]

32 (a) (rate of) <u>flow</u> of charge / electrons / ions

accept movement for flow

*do **not** accept flow of electricity*

1

(b) 7(.0)

accept 6.96 / 6.95 or an answer that would approximate to 6.96 if rounded

*allow **1** mark for obtaining correct power and changing to watts ie 1600*

or

*allow **2** marks for correct substitution and transformation ie 1600 ÷ 230*

*an answer 0.00696 / 0.007 gains **2** marks*

*allow **1** mark for 1.6 / 230 or 1.7 / 230*

*an answer 7.39 or 7.4 gains **2** marks*

3

amp (ere)

accept A

1

[5]

33 (a) 32,400,00 J

*allow **1** mark for correct substitution*

$3.24 \times 10^{\wedge 7}$ J

2

(b) (3kW) fan heater

accept 3kW

accept the middle one

1

(c)

features common to more than one heater, treat as neutral

<u>oil-filled</u>

low level heat

cannot be knocked over / space saving / no trailing wires

*do **not** accept just wall-mounted*

or more control over heat output

*do **not** accept just 3 heat settings*

1

<u>fan</u>

warms (office) rapidly **or** can be used to cool air (in summer)

accept can be used as a fan
accept cool air fan (setting)
accept 'it has a cool air setting in case it gets too hot'
*do **not** accept a specific reference to cooling the heater*

1

<u>ceramic</u>

can be switched on for set periods of time

*do **not** accept just has a timer*

or can be switched on before office is used / switched off automatically at night

1

[6]

34 (a) 230

1

50

1

(b) (i) has a plastic case

accept outside is plastic
accept cover / handle/ hair dryer is plastic / non-conductor

or does not have a metal case **or** plastic is an insulator

accept is double insulated

1

(ii) copper

1

[4]

35 (a) voltmeter

and no other

*do **not** accept voltage*

1

(b) (i) variable resistor

1

(ii) 0.10 – 0.30

accept 0.1 – 0.3

accept 0.3 – 0.1

accept 0.30 – 0.10

1

(iii) 3.3 (W)

*allow **1** mark for correct data choice*

*allow **2** marks for substitution of correct data i.e. 0.30 × 11.0*

*the following answers gain **2** marks*
0.10 / 0.30 / 0.80 / 1.75

*allow **1** mark for substitution of incorrect of data incorrectly calculated e.g.*
*0.20 × 4.0 = 0.6 scores **1** mark*

3

(c) increases

1

[7]

36 (i) 30

*allow **1** mark for showing correct method i.e. 5 × 6 **or** 12 ÷ 0.4*

2

(ii) connected in <u>series</u>

insufficient they are not connected in parallel

1

(iii) 0.4

1

(iv) equally/ evenly

the same is insufficient
allow credit for candidates that correctly mention pd across the connecting wires
accept (nearly) 2 V (each)

1

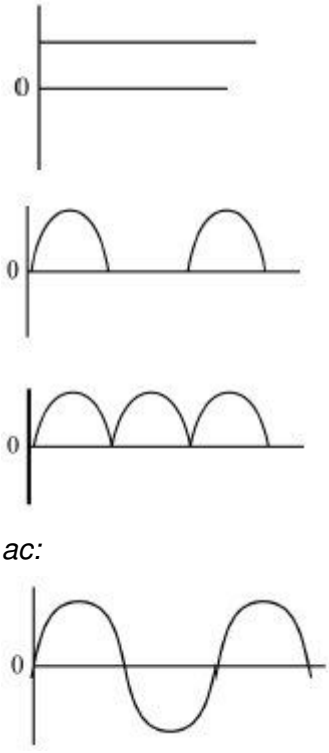
[5]

37 (a) d.c. flows in (only) one direction

1

a.c. <u>changes</u> direction (twice every cycle)

accept a.c. constantly changing direction
ignore references to frequency
accept answers presented as a clear diagram
e.g.



1

(b) (i) 10

*allow **1** mark for correct transformation and substitution i.e.*

$\frac{2.3}{230}$ *or* $\frac{2300}{230}$ *an answer 0.01 gains **1** mark*

2

(ii) 13 A

e.c.f.

accept the fuse size that is the next listed value greater than answer (b)(i)

1

[5]

38 (a) electrical

1

sound

correct order only

1

(b) the energy transformed by the TV will be destroyed

1

(c) a higher efficiency than

1

[4]

39 (a) (i) France

1

(ii) any **one** from:

- different homes have different appliances(*)
- different homes have different numbers of appliances(*)
  (*) accept all homes are different
- standby power not the same for all appliances
- some people will switch appliances off
  accept named appliances
  accept people waste different amounts of energy
- homes have different numbers of residents
- can't measure every (individual) home
  accept any sensible suggestions
  *do **not** accept answers in terms of accurate / precise etc*

1

(b) (i) increases amount of energy wasted
accept (encourages) people to leave appliances on (standby)
accept increases it

1

(ii) any **two** from:

- less electricity needed / generated
- fewer power stations needed
- less coal is burned
  *do **not** accept coal is non-renewable / running out*
  answers in terms of fuel stocks neutral
- less pollutant gases produced
  accept named gases
  accept harmful for pollutant
  accept greenhouse gases
  accept reduce / slow / stop global warming
  accept reduces acid rain

2

(c) joule

1

(d) (i) 6800
*accept £68 for **3** marks an answer of 68 gains **2** marks*
*allow **2** marks for correct substitution ie 400 × 17*
*allow **1** mark for obtaining 400*
*answers of 7480, 4760, 12920, 4080 gain **2** marks*

3

(ii) a small . . . . . electricity

1

[10]

40 (a) (i) 0.6

accept 60 %
*allow **1** mark for useful energy = 480*
*answer 0.6 with any unit or 60 gains **1** mark only*

2

(ii) transferred to surroundings

accept goes into the air
accept heats the surroundings up
accept gets spread out
accept transferred into heat (only)
*do **not** accept wasted / lost unless qualified*
destroyed negates mark
transferred into light / sound negates mark

1

(b) (i) 1.75

*allow **1** mark for converting to kW*
*answers of 0.7, 0.525, 0.35, 0.875, 1.05, 5.25 gains **1** mark*
*answers of 1750 or 17.5 gains **1** mark*

2

(ii) 21p or £0.21 or their (b)(i) × 12

1

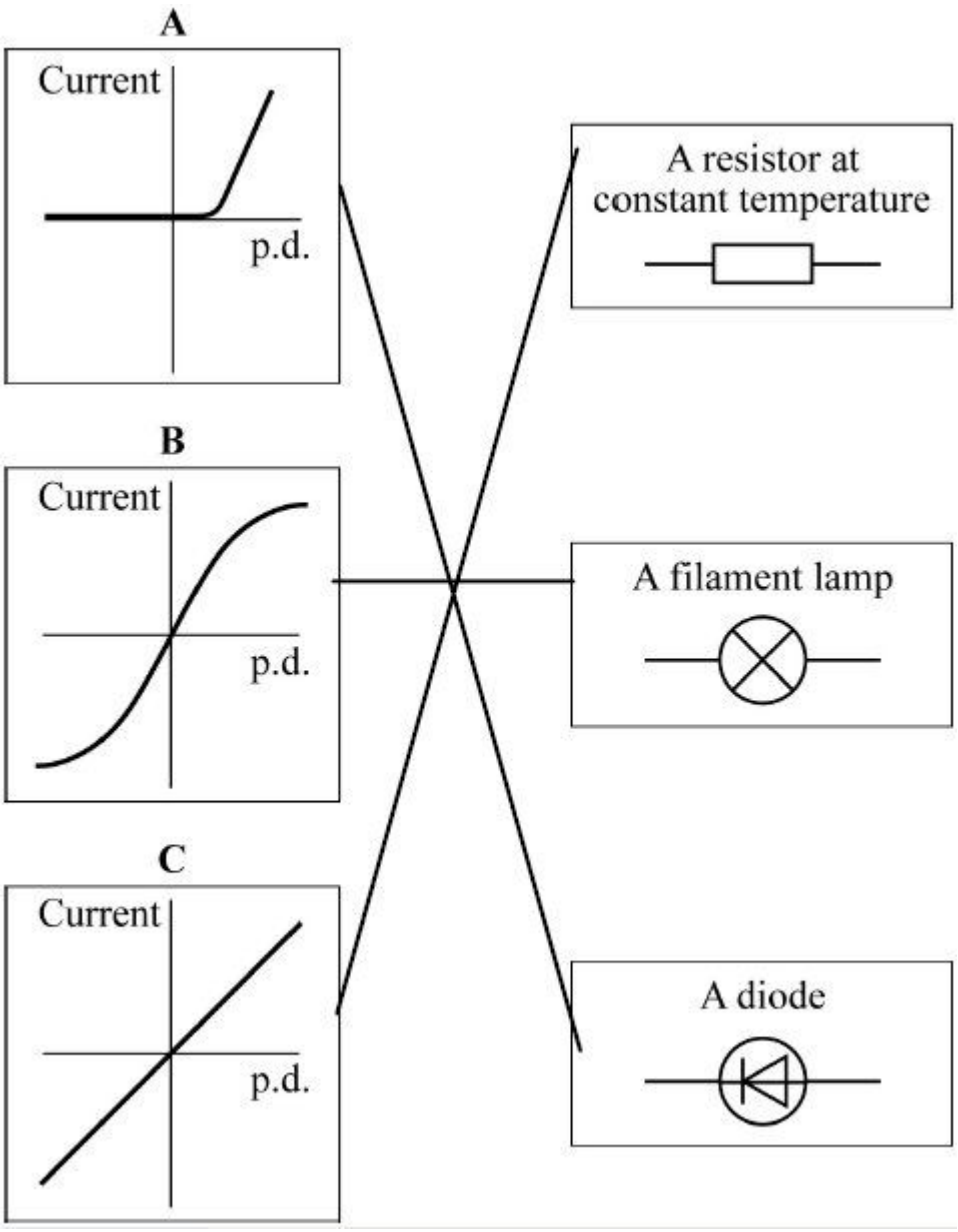
(c) any **two** from:

- (more) electricity needs to be generated
  (more) electricity is being used
- (more) power stations needed
- (more) fossil fuels burnt
  accept named fossil fuel
- (more) pollutant gases emitted
  accept named gas
  accept harmful for pollutant
  accept greenhouse gases
  accept atmospheric pollution
  accept answer in terms of any form of electricity generation and an associated environmental problem

2

[8]

41 (a) **three** lines drawn correctly



*allow **1** mark for 1 correct line*
if more than one line goes from a graph, both are incorrect

2

(b) **J**

1

[3]

42 (a) (i) 6

1

(ii) 6 (volts)

accept their (a) (i) ignore any units

1

(b) 0.30

accept 0.3

1

(c) smaller(than)

accept correct alternatives to smaller than e.g. less than

1

a bigger current flows through the lamp

only accept if 'smaller than' is given
accept converse
accept a correct calculation
accept resistance is half of 60
accept resistance = 30 (Ω)
*do **not** accept answers in terms of p.d*

1

[5]

43 (a) (i) 0.0046

accept 4.6 mA

*allow **1** mark for correct substitution and transformation*

i.e. current = $\frac{230}{50000}$

*an answer of 4.6 gains **1** mark*

2

(ii) • increases overall resistance

1

• (in event of a shock) gives a smaller current

accept gives smaller shock
*do **not** accept no shock/current*

1

(b) (i) 50 (hertz)

ignore units

1

(ii) NO has the lowest current at which people cannot let go

answer and reason needed
accept a sensible reason in terms of their answer to (b) (i)

or YES changing the frequency changes the current by only a small amount

1

(c) a current flows through from the live wire/metal case to the earth wire

accept a current flows from live to earth
*do **not** accept on its own if the current is too high*

this current causes the fuse to melt

accept blow for melt

2

[8]

44 (a) electric drill **C**

1

MP3 player **E**

1

toaster **B**

1

(b) (i) 2100

no unit required / ignore units
accept 2.1 kW must have units for this

1

(ii) **Y**

1

(iii) bar drawn with any height greater than **Y**

ignore width of bar

1

(c) (i) any **one** from:

answers must be a comparison

- holds more water
  *do **not** accept 1 litre of water on its own*
- works in other countries
  accept a named country
  accept works at 2 voltages
- boils faster
- has a more powerful element
  *do **not** accept 1 kW element on its own*
- can filter water

1

ignore can wash filter

(ii) any **one** from:

- it weighs less
- smaller to pack
- cheaper to use

answers must be a comparison
***or** state why the chosen feature is an advantage*
accept boils enough for one drink

1

[8]

45 (a) £15

*allow **1** mark for use of 125 (kWh)*
*allow **1** mark for an answer 1500*
*allow **both** marks for 1500 pence / p*
*allow **1** mark for correct calculation of annual cost for either freezer (£27 and £42)*

2

(b) £45

or their (a) × 3

*allow **1** mark for correct use of 3*
*allow **1** mark for 12 – 9 = 3*

2

(c) any **two** from:

the marks are for the explanation

yes **plus** explanation

- less electricity / energy needed / used

  accept less energy wasted

- less (fossil) fuels burned

  accept a named fossil fuel
  *do **not** accept conserving (fossil) fuels*

- less polluting gases emitted

  accept a named polluting gas / greenhouse gases / carbon emissions / reduce global warming
  accept an answer in terms of nuclear fuel
  eg less nuclear fuel required (1)
  less nuclear waste (1)

2

or no **plus** explanation

- old freezer must be disposed of
- hazardous chemicals inside freezer

  accept CFC gases

- *(*lot of*)* energy used in producing new freezer

[6]

46 (a) (i) hairdryer 13

all correct

saw 3

*allow **1** mark for 2 correct*

1

mixer 13

1

(ii) fuse melts

accept blows/ breaks/ snaps for melts
*do **not** accept blows up*
*do **not** accept fuse gets hot on its own*
*do **not** accept does not work on its own*

1

(b) (i) 920

*allow **1** mark for correct substitution*

2

(ii) no earth (wire)

1

outside / case may become live

cause a fire insufficient

or danger of electric shock

1

(c) (i) L and N

both required

1

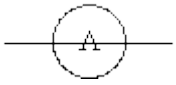
(ii) 9 (volts)

correct answer only

1

[9]

47 (a) (i) ammeter symbol correct and drawn in series

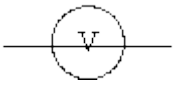


accept

*do **not** accept lower case a*

1

voltmeter symbol correct and drawn in parallel with the material



*do **not** accept*

1

(ii) adjust / use the variable resistor

accept change the resistance

or change the number of cells

accept battery for cell
accept change the p.d / accept change the voltage
accept increase / decrease for change

1

(b) (i) data is continuous (variable)

1

(ii) 36 (Ω)

correct answer only

1

(iii) 5.4 or their (b)(ii) × 0.15

*allow **1** mark for correct substitution*

2

(c) (i) the thicker the putty the lower the resistance

answer must be comparative

accept the converse

1

(ii) any **one** from:

- measuring length incorrectly

  accept may be different length

- measuring current incorrectly

  *do **not** accept different currents*

- measuring voltage incorrectly

  *do **not** accept different voltage*

- ammeter / voltmeter incorrectly calibrated

- thickness of putty not uniform

- meter has a zero error

  accept any sensible source of error eg putty at different temperatures

  *do **not** accept human error without an explanation*
  *do **not** accept pieces of putty not the same unless qualified*
  *do **not** accept amount of putty not same*
  *do **not** accept systematic / random error*

1

(iii) repeat readings

accept check results again
accept do experiment again
accept do it again
accept compare own results with other groups

*do **not** accept take more readings*

1

[10]

48 (a) clothing and seat rub together

accept friction between clothing and seat

1

electrons transfer from seat to driver

or

electrons transfer from driver to seat

accept electrons transfer on its own if first mark scores

*an answer in terms of rubbing, between clothing and seat **and** charge transfer without mention of electrons gains **1** mark*

*an answer in terms of friction / rubbing **and** electron transfer without mention of clothing and seat gains **1** mark*

1

(b) (i) how wet the air is affects charge (build up)

accept humidity affects charge

or

damp air is a better conductor

or

damp air has a lower resistance

*do **not** accept fair test or as a control unless explained*

1

(ii) No – it was only the lowest under these conditions

accept answer in terms of changing the conditions may change the results

or

No – there are lots of other materials that were not tested

or

Yes – the highest value for cotton is smaller than the lowest value for the other materials

*do **not** accept results show that it is always less / smallest*

1

[4]

49 (a) iron

1

hairdryer

1

kettle

answers can be in any order

1

(b) sound

1

(c) is more efficient than

1

[5]

50 (a) £19.20

*allow **1** mark for correct substitution*
ie 160 × 12
*allow **1** mark for an answer (£)1920*
*an answer of 1920p gains **both** marks*
*an answer of £40.80 gains **both** marks*
*allow **1** mark for 340 × 12*

2

(b) 340

*allow **1** mark for correctly using the reading 62580*
ie 62920 − 62580
*accept £40.80 for **both** marks*

2

[4]

51 (a) (i) electrons

1

jumper

1

(ii) positive

accept protons
accept +

1

(iii) positively charged

accept any clear way of indicating the answer

1

(b) (i) copper

1

it is an (electrical) conductor

only accept if copper is identified

*do **not** accept it conducts heat*

accept it conducts heat and electricity

accept copper is the best conductor

accept correct description of conduction

1

(ii) current

1

[7]

52 (a) (i) blue

1

(ii) earth

1

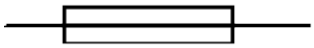
(iii) rubber / plastic

*accept any suitable **named** non conductor eg polypropylene*

*do **not** accept bakelite*

*do **not** accept an insulator*

1

(iv) 

1

(b) any **two** from:

- draws too high a current

  accept power for current
  *do **not** accept electricity/ electric for current*
  accept too much current goes through the socket
  *do **not** accept too many currents go through the socket*

- socket overloaded

  *it = socket do **not** accept circuit for socket*

- wiring gets too hot / melts

  accept socket for wiring
  *do **not** accept fuse melts or blows*
  *do **not** accept plug/ appliances overheating*

- (may) cause a fire

- (may) cause sparking

- (possible) physical damage to the socket

  a physical reason, such as stick out from the wall is insufficient
  ignore reference to electric shocks

2

[6]

53 (a) (i) 4 (V)

*allow **1** mark for correct substitution*

2

(ii) 5 (V) or (9 – their (a)(i)) correctly calculated

e.c.f
*do **not** allow a negative answer*

1

(b) (i) <u>thermistor</u>

c.a.o

1

(ii) 0°C to 20°C

1

[5]

54 (a) alternates

accept switches
accept (constantly) changes
accept goes up and down

1

between positive and negative

1

(b) potential difference between the neutral and earth (terminal)

accept voltage for p.d

or potential of the neutral terminal with respect to earth

1

(c) (i) 0.025 (s)

1

(ii) 40 (Hz)

accept 1 ÷ their (a)(i)

1

[5]

55 (a) kinetic

accept movement

1

(b) (i) 3 (kWh)

allow 1 mark for selecting the correct information

1

(ii) transfers more energy

accept transform or use for transfer

accept electricity for energy

*allow higher (average) power **and** switched on for more time*

2

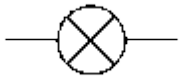
(iii) any **one** from:

- use the internet
- brochures
- reading adverts
- visiting shops
- recommendation from friends / plumbers

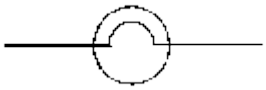
1

[5]

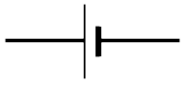
56 (a) circuit symbol for a lamp correct



accept



accept any standard of drawing providing circuit would work



1

circuit symbol for a cell correct

1

2 lamps drawn in parallel with 3 cells

polarity of cells must be correct (+ to –) but cells may be either way around

1

(b) 4.5

1

(c) the same as

accept any clear indication of the correct answer

1

[5]

57 (a) (i) heat

1

(ii) temperature increases **or** (cause) convection (currents)

accept gets warmer
accept gets hotter

1

(iii) 60% **or** 0.6

60 without % scores 1 mark
0.6 with a unit scores 1 mark
60 with incorrect unit scores 1 mark

or correct substitution $\frac{120}{200}$
for 1 mark

2

(b) street

1

more (energy transferred as) light or less (energy transferred as) heat or useful energy output the highest

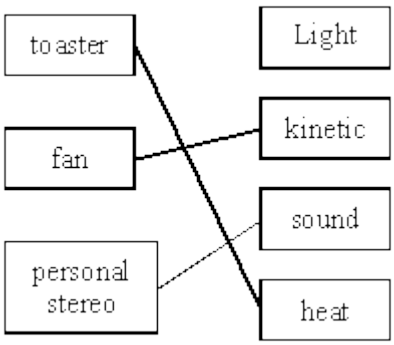
can only score this mark if first mark scored

all efficiencies calculated correctly score 2nd mark point

1

[6]

58 (a) each correct line scores 1 mark



if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines

3

(b) toaster

accept 1.2 kW

1

(c) (i) 400

1

(ii) £24 or 2400p

full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit
an answer of 24 or 2400 with no unit or the incorrect unit scores 1 mark
(c)(i) × 6 incorrectly evaluated scores 1 mark

2

(d) 6

allow 6000 for 1 mark
allow 3 × 2 for 1 mark

2

[9]

59 (a) (i) potential difference = current × resistance

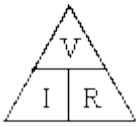
*accept voltage **or** pd for potential difference*

accept V = I × R

accept correct transformation

*do **not** accept V = C × R*

*do **not** accept V = A × R*

accept 

provided

subsequent use of Δ correct

*do **not** accept an equation expressed in units*

1

(ii) 46

*credit correct transformation for **1** mark*

allow 1 mark for use of 11.5 V or division of final resistance by 20

*a final answer of 920 gains **2** marks only*

3

ohm(s)

accept symbol Ω

*do **not** accept Ω s*

unit / symbol mark can be awarded in (iii) provided unit / symbol is omitted in (ii)

1

(iii) 920 (ohms) **or** their (a)(ii) × 20

1

(b) as temperature increases, resistance increases

accept hotter for temperature increase

*do **not** accept a reference to resistance only i.e. it / resistance goes up*

1

[7]